Optimal Artificial-Recharge Planning to Raise the Groundwater Level of Land Subsidence Area

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The alluvial fan of the Zhuoshui River in Taiwan has rich groundwater resources. However, the groundwater over-pumping to supply the agricultural and aquaculture water demand in early year induced drawdown of groundwater level significantly, and caused land subsidence problems. To mitigate the land subsidence problem, raising the groundwater level is the most effective method.
Therefore, this study develops an optimal planning model for regional groundwater recharge planning and applies the model to the Zhuoshui River alluvial fan. The optimal planning model integrated a genetic algorithm with a surface water allocation model and a groundwater simulation model. To reduce the computational complexity, the optimal planning model is formulated as a sequential optimization model instead of a global optimal one. The model computes the optimal recharge plan step by step. For each step, three consecutive time steps optimal was considered. To further increase the computational efficiency, a response matrix model is used to surrogate the groundwater numerical simulation model, MODFLOW. However, before creating a response matrix, a groundwater simulation model (MODFLOW) needs to be built. The optimal planning model was applied to compute the optimal recharge plain in the Zhuoshui River alluvial fan. The retired water treatment plants are the candidate sides to be selected as injection sites. The simulation results demonstrated that the optimal recharge plan can indeed raise the groundwater level significantly. The principle of the proposed methodology can be applied to other land subsidence areas, and the result is a valuable reference for mitigating the land subsidence problem

